Prethodno priopćenje/Preliminary report
UDC/UDK 339.5 (497.4:100)

# Examining Slovenian trade flow sustainability: empirical evidence from the period of the EU membership

# Testiranje održivosti trgovinskih tijekova Slovenije: empirijsko istraživanje tijekom razdoblja članstva u EU

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## Abstract

The main aim of this research is to examine Slovenian trade flows in goods and services with the rest of the world since joining the European Union (EU) in May 2004. We applied Granger causality test and Vector Error Correction Model (VECM) on quarterly data from the first quarter of 2005 up to the first quarter of 2017. Applied Hansen and Seo (2002) test confirmed the assumption of linearity in the relationship between the variables under consideration and therefore the appropriateness of the empirical approach for the purpose of this paper. The research results indicate importing to exporting as a dominant trade pattern in the Slovenian economy and successful trade balance with the rest of the world since Slovenia joined the EU.

**Keywords:** Vector Error Correction, imports, exports, Slovenia
**JEL classification:** C01, C05, C34, F1, F4

## Sažetak

Glavni cilj ovog istraživanja je analizirati trgovinske tijekove roba i usluga Slovenije s ostatkom svijeta od pridruživanja Europskoj uniji (EU) u svibnju 2004. godine. Empirijsko istraživanje provedeno je primjenom Grangerovog testa uzročnosti i Vektorskog modela korekcije pogrešaka (VECM) koristeći tromjesečne podatke od 2005. do 2017. godine. Primijenjeni Hansen i Seo (2002) test potvrdio je pretpostavku linearnosti između promatranih varijabli i prikladnost empirijskog pristupa u radu. Rezultati istraživanja ukazuju na dominaciju uvoza nad izvozom u trgovinskom obrascu slovenskog gospodarstva i pozitivnu trgovinsku bilancu s ostatkom svijeta od vremena njenog pristupanja Europskoj uniji.

**Ključne riječi:** vektorski model korekcije pogrešaka, uvoz, izvoz, Slovenija
**JEL klasifikacija:** C01, C05, C34, F1, F4

## 1. Introduction

The world market has become highly integrated and this is mostly due to the rapid growth of international exchange. A closer connection between countries may bring mutual benefits for trading countries because producers in each country can use the advantages of specialization and the economy of scale and consumers can consume a wider range of products at a lower price than would normally be possible if there was no trade (Grgić and Bilas, 2009). Exports and imports thus play a complementary role in the growth process, especially in small, open and developing countries. Foreign trade is necessary for developing and diversifying the exports sector, which depends largely on imported inputs. The knowledge whether exports and imports are cointegrated is of importance for policymakers while designing appropriate policies and measures for achieving external balance.

Regional trade agreements are a growing global trend and nearly every country in the world participates in one, or even several trade agreements. It is generally believed that developed countries seek deeper forms of integration whereas developing countries tend to enter into regional trade agreements to benefit from access to a larger market. Slovenia together with Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland and Slovakia joined the European Union (EU) in the year 2004. Since Slovenia is a small and open economy it is useful to see how Slovenian trade flows developed after joining the EU. In order to examine Slovenian trade flows, we use the concept of trade flows sustainability laid down by Husted (1992). His paper seeks to understand the recent history of U.S. external imbalances by identifying the long-run tendency of the U.S. current account balance and investigating its behavior. The adopted procedure is to estimate cointegrating regressions between U.S. exports and imports of goods and services. The author concluded a long-run relationship between exports and imports and found that there was a tendency in the U.S. exports and imports to converge in the long-run.

The remainder of the paper is organized as follows: Section 2 briefly summarizes existing empirical literature related to the subject of consideration. Section 3 presents research data and empirical strategy as well as corresponding methodology, while Section 4 gives empirical results and discussion. The final section provides a concluding overview of the main findings of the research.

## 2. Brief literature overview

Export-import cointegration indicates that countries have not violated intertemporal budget constraints due to accurate macroeconomic policies (Husted, 1992; Erbaykal and Karaca, 2008). On the contrary, persistent current account deficits pose serious economic problems and require policy intervention (Baharumshah et al., 2003). Using quarterly data and Johansen and Juselius's cointegration technique, Bahmani-Oskooee and Rhee (1997) found that South Korea's exports and imports are cointegrated and the coefficient on exports was positive. This result implies that South Korea does not violate its international budget constraint.

Erbaykal and Orhan (2008) explored the relationship between imports and exports of Turkey over the period 1982-2005. By using the cointegration and error-correction analysis, they showed that imports and exports are cointegrated, and that long-run relationship between them exists. Herzer and Nowak-Lehmann (2006) examined the causality between imports and exports for Chile over the sample period of 1960-2000. Cointegration and Granger causality tests indicated a unidirectional causality running from exports to imports.

Ali (2013) analyzed the long-run association between Pakistan's exports and imports. Empirical analysis revealed a long-run relationship between the two variables. The error correction model results showed that exports and imports converge towards the long-run equilibrium. This indicates the effectiveness of macroeconomic policies in stabilizing the international trade balance in Pakistan

In his study, Babatunbe (2014) examined the long-run relationship between Nigerian exports and imports between 1960 and 2014 in Nigeria. Exports and imports were disaggregated into oil and non-oil components. The application of the Johansen Bound testing and the Hansen parameter instability test as cointegration techniques revealed that Nigerian exports and imports at the aggregate and disaggregated level are cointegrated with the cointegration coefficient very close to unity. This indicated that Nigeria's macroeconomic policies have been effective in the long-run and suggested that Nigeria is not in violation of its international budget constraint.

Olumuyiwa and Oluwasola (2016) investigate the long-run relationship between exports and imports in thirteen Economic Community of West African States member countries during 1970-2015. Evidence points to cointegration of exports and imports in eight of the countries using the bounds testing approach to cointegration. The sign and significance of the error correction term estimates reinforce evidence of cointegration.

Bekó (2002) provides an overview of the related topic before the Slovenian EU accession. He employs conditional causality technique to identify the possible empirical relationship or relationships between exports, imports and economic growth in the transition period of the Slovenian economy. Four main conclusions can be drawn from the analysis. Firstly, the evinced bi-directional causality between exports

and variables of economic activity in aggregate data, in manufacturing as a whole and in the majority of the sub-sectors (industries) examined, suggests that any characterization of a small country's growth as export-driven may be perfunctory at least. Secondly, on aggregate-level data, imports of goods and services are clearly governed by domestic incomes. Thirdly, neither aggregate-level data nor total manufacturing provide any support for the modernization hypothesis, since exports of goods (and services) drive the corresponding import flows. Fourthly, causality estimates of sub-sectoral exports, imports and production suggest that the majority of manufacturing industries display a circular causality, in which the endogenous of the variables observed leaves only limited scope for policy engagements. Aristovnik and Meze (2014) analyzed the impact of the euro introduction on the trade of the EU members and pointed that Slovenia could primarily expect from the euro's introduction a surge in its imports from the Eurozone and only a minimum rise in exports.

## 3. Research data and methodology

Following the work of Husted (1992), Arize (2002), Al-Khulaifi (2013), and Pillay (2014), this paper examines Slovenian trade flows within a framework of trade sustainability. The representative agent can borrow and lend on international markets at the world interest rate level using one-time financial instruments with the objective of maximizing lifetime utility subject to the budgetary constraints. The representative agent's current-period budgetary constraint in a period is given by the term:

$$C_t = Y_t + B_t - I_t - (1+r_t)\cdot B_{t-1} \quad (1)$$

Where $C_t$, $Y_t$, $B_t$, $I_t$ represent current consumption, output, international borrowing, and investment, respectively. Then, $r_t$ represents the one-time basis world interest rate, and $(1 + r_t)\cdot B_{t-1}$ is the debt of the agent from the previous period. Equation (1) must hold in every time period. In addition, periodical budgetary constraints can be combined from the country's intertemporal budgetary constraint which states that the amount a country borrows (lends) in international markets equals the present value of future trade surpluses or deficits. Iterating forward from some initial period and holding assumptions that the world interest rate is stationary while exports ($EXP_t$) and imports ($IMP_t$) are non-stationary at different levels, Husted (1992) derived and tested the following model:

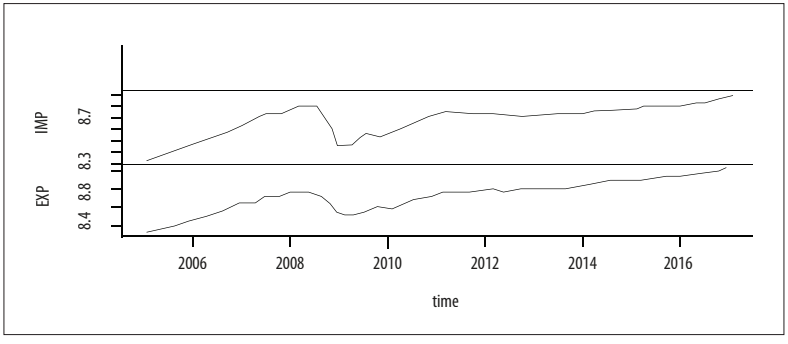
$$EXP_t = \alpha + \beta \cdot I\,MP_t + \varepsilon_t \quad (2)$$

On the other hand, Arize (2002) tested other model using the following equation:

$$IMP_t = \alpha + \beta \cdot E\,XP_t + \varepsilon_t \quad (3)$$

where $IMP_t$ represent imports and $EXP_t$ represent exports. The intertemporal international budgetary constraint is stable when there is a long-run relationship between imports and exports. The satisfaction of the intertemporal international budgetary constraint requires that $\beta$ in equation (2) or

**Figure 1** Slovenian trade flows (imports and exports)




**Source:** the authors.

**Table 1** Descriptive statistics for the observed variables

| | log (IMP) | log (EXP) |
|---|---|---|
| Min. | 8.323 | 8.303 |
| 1st Qu. | 8.610 | 8.608 |
| Median | 8.734 | 8.771 |
| Mean | 8.688 | 8.733 |
| 3rd Qu. | 8.779 | 8.839 |
| Max. | 8.915 | 9.047 |

**Source:** the authors.

in equation (3) should be equal to one; otherwise, the economy would not be able to fulfill its foreign liabilities.

This research is based on quarterly data on imports and exports of goods and services. The Slovenian case is examined on the data sample from the first quarter of 2005 to the first quarter of 2017 and gathered from the Statistical Office of the Republic of Slovenia. The observed series are X-13-ARIMA seasonally adjusted and taken in (natural) log values (Figure 1).

Visual inspections of the observed series in Figure 1 indicate a potential cointegrating relationship between the imports and exports series in Slovenia. Descriptive statistics of the observed series is provided in Table 1.

Descriptive statistics in Table 1 show higher variation range of exports series in comparison to the imports series.

Stationarity diagnostic is provided by unit root tests (ADF, PP, KPSS). Following unit root test results, linear Johansen (1995) cointegration test is implemented and results indicate the presence of bivariate cointegration between imports and exports in Slovenia. In order to confirm the causality direction, Granger (1969) Causality test was also employed. Following Johansen (1988, 1991) and Johansen and Juselius (1990), linear vector error correction model (VECM) is estimated.

VECM specification for the case of two-time series and both integrated of the same order can be represented by the equation:

$$\Delta x_t = A' X_{t-1}(\beta) + u_t \qquad (4)$$

Where:

$x_t$ - $p$ is dimensional I(1) cointegrated time series with p $x$ 1 cointegrating vector, $\beta, A$ - coefficient matrix k $x$ p| k = p + 2.

($X_{t-1}(\beta)$) is a regressor and a k $x$ 1 matrix is given by the equation (5):

$$X_{t-1}(\beta) = \left[1 \quad w_{t-1}(\beta) \Delta x_{t-1} \cdots \Delta x_{t-l}\right]' \qquad (5)$$

The term $w_{t-1}(\beta) = \beta' x_{t-1}$ is an error-correction term that needs to be stationary.

Then, $u_t$ is a vector martingale difference sequence with finite covariance matrix as presented in equation (6):

$$\sum = E(u_t u_t') \qquad (6)$$

A linear approach to error correction modelling assumes that the speed of adjustment towards the long-run equilibrium is the same in every time period. Since the adjustment may occur only once the deviations from long-run equilibrium exceed some critical values (threshold) and therefore the assumption of linearity may not hold, as originally noted by Balke and Fomby (1997). To illustrate dynamic properties of the system variance decomposition and impulse response function are provided. Using variance decomposition, the variance of the forecast error of each variable is divided into the proportions attributable to innovations (or shocks) in each variable within the system including its own, and provides an indication of these relativities and can thus be considered as an out-of-sample causality test (Kling & Bessler, 1985). When the variable is fully forecasted from its own lagged values (autoregressions), all its forecast error variance will be explained by its own shocks (Sims, 1982). Impulse response function shows the effects of shocks on the adjustment pattern of the variables.

## 4. Empirical results and discussion

Following the methodology and empirical strategy

provided in Section 3, unit root test results are presented in Table 2.

Following the results of unit root tests, imports and exports in Slovenia are found to be integrated of order one I(1). Since the observed variables are of the same order of integration, the next step is conducting the cointegration test. Johansen cointegration rank tests results are provided in Table 3. Johansen cointegration rank test results indicate a cointegrating relationship between the observed series.

To examine the causality direction, the Granger Causality test was applied. Table 4 reports pairwise Granger Causality test results.

Test results in Table 4 show bidirectional Granger Causality between the observed series. Following unit root tests and cointegration test, we proceed to estimate vector error correction model to explain Slovenian trade flow pattern. The linear VECM estimates are summarized in Table 5.

The linear VECM estimates in Table 5 illustrate that exports govern more of the adjustment from the short-run than from the long-run equilibrium, since the absolute amount of coefficient with error correction term is somewhat higher in exports equation than in the imports equation. Hansen and Seo (2002) test confirms the linearity in the relationship between exports and imports. Based on the BIC value, the lag length is selected to be two ($l=3$). Diagnostics checking confirms all of the related assumptions (Ljung–Box test, ARCH test and Jarque–Bera test), so the estimates could be accepted as valid.

Forecast error variance decomposition (Table 6 in the Appendix) for the imports equation shows that imports account for more than 87% of the variation in the forecast error in imports equation, while exports explain less than 12% of the variance in imports equation. The results in exports equation are somewhat different (Table 6 in the Appendix). More than 70% of the variation in the forecast error in

**Table 2** Unit root test results for governments spending and GDP in Slovenia

| Variable and test | Levels | | First difference | |
|---|---|---|---|---|
| | Constant | Constant and trend | Constant | Constant and trend |
| **ADF test** | **t-stat.** | | | |
| log (IMP) | -2.419085 | -3.520004 | -4.572204 | -4.507889 |
| log (EXP) | -1.434716 | -3.313070 | -3.942306 | -3.872844 |
| **PP test** | **Adj. t-stat.** | | | |
| log (IMP) | -2.247410 | -2.712001 | -3.590311 | -3.525591 |
| log (EXP) | -1.768513 | -2.757521 | -3.743941 | -3.661961 |
| **KPSS test** | **LM-stat.** | | | |
| log (IMP) | 0.683247 | 0.070994 | 0.116209 | 0.083939 |
| log (EXP) | 0.843277 | 0.061859 | 0.124700 | 0.096227 |

**Source:** the authors.

**Table 3** Johansen cointegration rank tests

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | p –value |
|---|---|---|---|---|
| None | 0.317082 | 18.00648 | 15.49471 | 0.0205 |
| At most 1 | 0.001735 | 0.081612 | 3.841466 | 0.7751 |
| | | **Max-Eigen Statistic** | | |
| None | 0.317082 | 17.92487 | 14.26460 | 0.0126 |
| At most 1 | 0.001735 | 0.081612 | 3.841466 | 0.7751 |

**Source:** the authors.

**Table 4** Pairwise Granger Causality Tests (Lags 3)

| Null Hypothesis: | Obs | F-Statistic | p –value |
|---|---|---|---|
| | | | |
| IMP does not Granger Cause EXP | 46 | 7.49370 | 0.0004 |
| EXP does not Granger Cause IMP | 46 | 3.84659 | 0.0167 |

**Source:** the authors.

**Table 5** Linear VECM relationship estimates for the Slovenian case

| Variables | $\Delta \log (IMP)_t$ | $\Delta \log (EXP)_t$ |
|---|---|---|
| Intercept | 1.5166** (0.4913) | 1.5701*** (0.3771) |
| $w_{t-1}$ | -0.5071*** (0.1639) | -0.5202*** (0.1258) |
| $\Delta \log(IMP)_{t-1}$ | 0.6501** (0.3430) | 1.2081*** (0.2632) |
| $\Delta \log(\exp)_{t-1}$ | 0.1734 (0.4147) | -0.6770*** (0.3183) |
| $\Delta \log(IMP)_{t-2}$ | -0.5181 (0.3382) | 0.2624 (0.2596) |
| $\Delta \log(\exp)_{t-2}$ | 0.2190 (0.4163) | -0.6069** (0.3195) |
| $\Delta \log(IMP)_{t-3}$ | 0.3673 (0.3476) | 0.6284*** (0.2668) |
| $\Delta \log(\exp)_{t-3}$ | -0.1360 (0.3648) | -0.5017 (0.2800) |
| AIC: -687.2639 | BIC: -656.5507 | SSR: 0.0589708 |
| Cointegrating equation: | | log *(IMP)*-0.6532096·*log(EXP)* |
| Test of linear versus threshold cointegration of Hansen and Seo (2002): Test Statistic: 14.61344 (Maximized for threshold value: 2.960576 ) p-value: 0.14 ( Fixed regressor bootstrap ) | | |

Notes: Estimations are performed using the Maximum Likelihood (ML) estimator; standard errors are in brackets; ***,**,* denote significance at the 1% and 5% significance level, respectively.

**Source:** the authors.

exports equation is attributed to exports variation and less than 30% is explained by imports variation. These results indicate the dominance of importing to exporting pattern behavior in Slovenian trade flows. The impulse response function (Figure 2 in the appendix) illustrates one standard deviation shock. The response is presented for the period of ten quarters. Following Figure 2 in the Appendix, only positive impact is found in the exports equation, meaning that changes in imports result in positive reactions in exports. In the imports equation, positive impact and negative effects of shocks in exports are recorded. At first, the impact might be negative and can last for a year with the exception of the second quarter. Afterwards, the impact turns to be positive while changes continue and eventually disappear. Conclusively, Slovenia experienced a positive total trade account since joining the European Union in May 2004 (exports to imports ratio is shown in Figure 3 of the Appendix). The results are consistent with Bekó (2002) who explained Slovenian economy's success in creating a robust export base by appropriate import structure and emulation pressures arising from external demand (mainly in EU markets), foreign direct investments, etc. The soft facts, trade flow divers and environmental context are wider than the scope of this paper and are recommended to be researched in a separate paper.

## 5. Conclusion

There are several conclusions that can be drawn out of the research presented in this paper. First, linear vector error-correction model gives a proper representation of Slovenian trade flows since no empirical evidence was found to support the nonlinearity in the relationship between Slovenian exports and imports. Second, estimates of the presented paper indicate bidirectional causality between variables under consideration. Furthermore, the empirical results indicate that exports govern more of the adjustment when disequilibrium in the long- run relationship occurred and therefore, importing to exporting pattern dominates in the Slovenian economy. The occurred disequilibrium is being adjusted within less than two quarters and imports significantly influence exports in the three preceding quarters. Conclusively, Slovenia recorded a efficacious trade balance with the rest of the world while being a member of the European Union. These results can be of use for policymakers in designing the appropriate policy measures for achieving internal and external balance.

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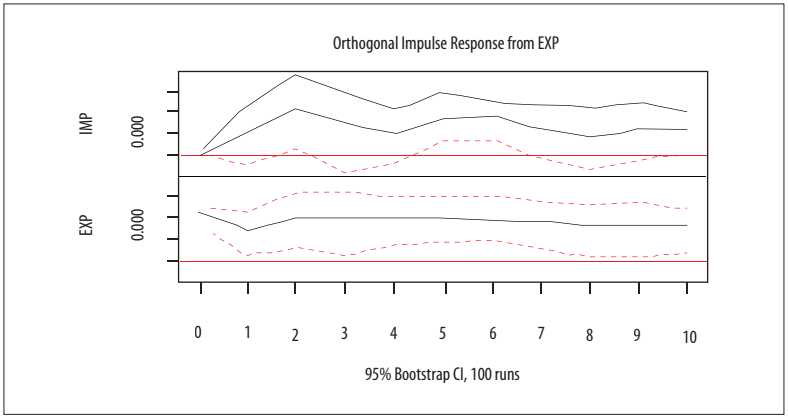
## Appendix

**Figure 2** Impuls response function for the Slovenian trade flows estimates



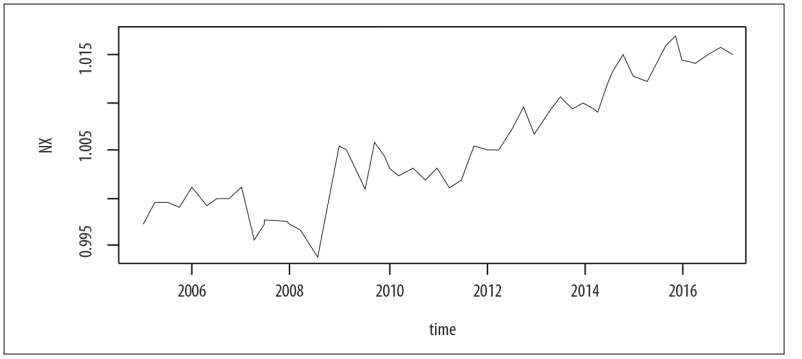

**Source:** the authors.

**Table 6** Forecast Error Variance Decomposition

| | Imports | | Exports | |
|---|---|---|---|---|
| Lag | IMP | EXP | IMP | EXP |
| [1,] | 1.0000000 0 | .00000000 | 0.7268839 | 0.2731161 |
| [2,] | 0.9872401 | 0.01275986 | 0.8792451 | 0.1207549 |
| [3,] | 0.9590168 | 0.04098321 | 0.8737974 | 0.1262026 |
| [4,] | 0.9515196 | 0.04848042 | 0.8454343 | 0.1545657 |
| [5,] | 0.9476986 | 0.05230138 | 0.8103856 | 0.1896144 |
| [6,] | 0.9327847 | 0.06721531 | 0.7838104 | 0.2161896 |
| [7,] | 0.9172466 | 0.08275337 | 0.7668542 | 0.2331458 |
| [8,] | 0.9150641 | 0.08493586 | 0.7648766 | 0.2351234 |
| [9,] | 0.9157039 | 0.08429610 | 0.7695895 | 0.2304105 |
| [10,] | 0.9132989 | 0.08670110 | 0.7730360 | 0.2269640 |
| [11,] | 0.9107615 | 0.08923847 | 0.7725579 | 0.2274421 |
| [12,] | 0.9095534 | 0.09044662 | 0.7692346 | 0.2307654 |
| [13,] | 0.9071061 | 0.09289387 | 0.7636815 | 0.2363185 |
| [14,] | 0.9025490 | 0.09745095 | 0.7560158 | 0.2439842 |
| [15,] | 0.8980703 | 0.10192968 | 0.7470483 | 0.2529517 |
| [16,] | 0.8942375 | 0.10576250 | 0.7379660 | 0.2620340 |
| [17,] | 0.8897202 | 0.11027980 | 0.7290894 | 0.2709106 |
| [18,] | 0.8845466 | 0.11545340 | 0.7204210 | 0.2795790 |
| [19,] | 0.8799321 | 0.12006790 | 0.7123943 | 0.2876057 |
| [20,] | 0.8758247 | 0.12417526 | 0.7053912 | 0.2946088 |

**Source:** the authors.

**Figure 3** Slovenian exports to imports ratio (NX)




**Source:** the authors.